82 The Cells of Producers

As you have been learning, producers such as plants play a unique role within an ecosystem. By transferring the sun's energy into chemical energy stored in food, plants provide energy in a form that can be used by consumers and decomposers. What is different about plants that allows them to do this? Find out by investigating the cells of plants and then comparing them to animal cells.

A botanist (a person who studies plants) gathers plants for his research.

CHALLENGE **How are the cells of producers such as plants different from the cells of consumers such as animals? How do plant cell structures relate to their function as producers?**

MATERIALS

For each group of four students

- 1 celery stalk
- 1 ½-in. slice of onion
- 1–2 leaves of *Elodea* (Anacharis)
- 1 fresh spinach leaf or similar plant leaf
- 1 pair of scissors
- 1 pair of forceps
- 1 bottle of Lugol's solution (optional)
- 4 droppers
- 1 cup of water
- 4 microscope slides
- 4 coverslips
- 2 microscopes
- 1–2 paper towels
- 1 toothpick
- 1 compass

For each student

- 1 Student Sheet 82.1, "Cell Drawings"

PROCEDURE

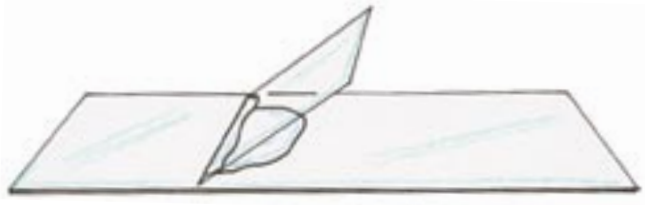
1. Have each person in your group complete one of the following four steps. You will share all four slides within your group.

   a. Pull a string of celery off the stalk. At the edge of the string, you will see a thin film. This is the outer layer of the celery stalk and the part where you will see plant cells most clearly. Use scissors to cut a short length of this outer film. Place this piece of celery on a microscope slide. Add a drop of water and slowly drop the coverslip, at an angle, into place (as shown in the figure below).

   b. Get a small square of onion. Use your forceps to peel off a thin film of tissue from the inside layer of the onion square. Place this thin film on a microscope slide. Add a drop of water and slowly drop the coverslip, at an angle, into place (as shown in the figure below).

   c. Get a piece of *Elodea* and break off a leaf. Place a piece of this leaf on a microscope slide. Add a drop of water and slowly drop the coverslip, at an angle, into place (as shown in the figure below).

   d. Get a fresh spinach leaf or similar plant leaf. Use the toothpick to gently scrape some plant cells from the underside of the leaf. Place some of the scrapings on the slide. Add a drop of water and slowly drop the coverslip, at an angle, into place (as shown in the figure below).



PLACING THE COVERSLIP

2. With your partner, observe the cells of each plant. Begin by observing the slide on low power (usually the 4x objective). Be sure that the plant material is in the center of the field of view (you may need to move the slide slightly) and completely in focus before going on to Step 3.

   Hint: When viewing celery, focus on the thinnest parts of the sample.

3. Without moving the slide (which can be secured with stage clips), switch to medium power (usually the 10x objective). Adjust the microscope settings as necessary.

   Hint: If material on the slide is too dark to see, increase the amount of light on the slide: do this by slightly opening the diaphragm under the stage.

4. Turn the fine focus knob up and down just a little to reveal details of the plant cells at different levels of the slide.

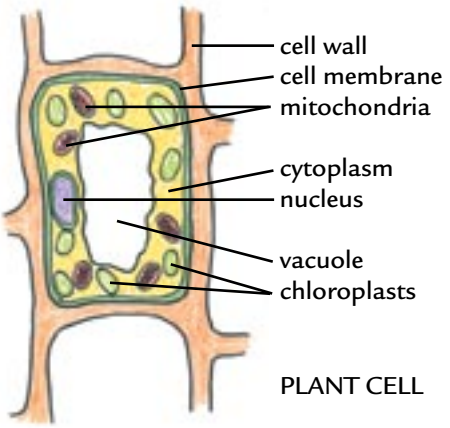
5. Draw your observations of a cell from each plant. Be sure to record the type of plant and the level of magnification. Include details inside the cell and along the edge of the cell membrane on your drawing.

6. When you have completed your observations, turn off the microscope light and set the microscope back to low power.

EXTENSION

Place a drop of salt water at the edge of the coverslip while looking at either the piece of *Elodea* or the piece of red onion. Place the corner of a paper towel at the opposite edge of the coverslip. What happens? What does this tell you about the importance of fresh water to plants?

ANALYSIS



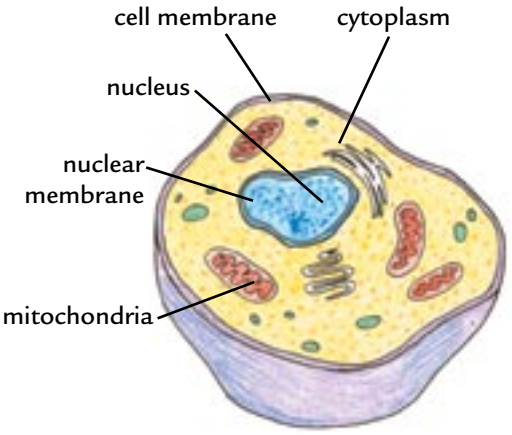
PLANT CELL

1. Using various microscope techniques, scientists have identified the structures most commonly found in plant cells. Some of these structures are shown in the diagram of the plant cell at right. Not all plant cells contain every structure, though most plant cells do contain the majority of them. However, some of these structures are very difficult to observe if you only use a light microscope.

   a. Which cell structures appear to be ones that you observed? List them.

   b. Which cell structures were not visible to you? List them.

2. Compare the various plant cells you observed. Which cell structures did all of the plant cells appear to have in common?



ANIMAL CELL

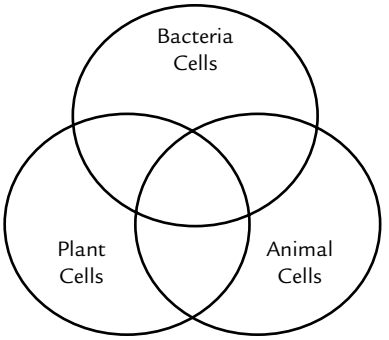
3. Look at the simplified diagram of an animal cell shown at left. Animal cells, as well as plant cells, contain many structures; this diagram shows only some of these structures.

   a. Which cell—plant or animal—is the cell of a consumer?

   b. Compare the plant cell diagram with the animal cell diagram. Based on these diagrams, what structures would you expect to find in both plant and animal cells?

   c. Based on your comparisons, which structure(s) within a plant cell do you think is most important in food production?

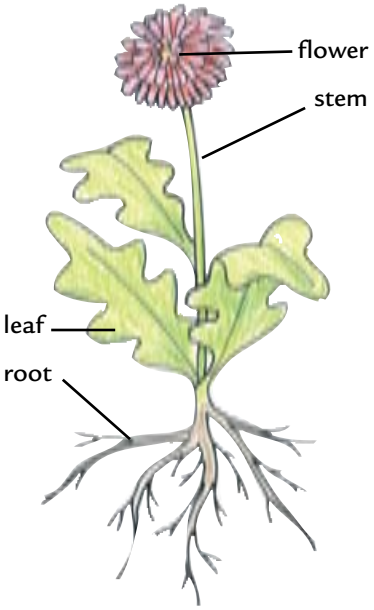
4. Copy a larger version of the Venn diagram shown here. Complete it by writing in the characteristics of animal cells, plant cells, and bacterial cells (which you may have first studied in Activity 44, "Who's Who?"). Record unique features of each type of cell in the individual spaces. Record common features among groups in the spaces that overlap.



5. a. Many plants have leaves, stems, roots, and—during the blooming season—flowers. Which of these parts are likely to absorb sunlight and carry out photosynthesis?

b. Of the cells you observed—celery stem, onion, *Elodea* leaf, and the other plant leaf—which would you expect to carry out photosynthesis?

c. What cell structures are seen only in cells that absorb sunlight and carry out photosynthesis?



6. Three of the introduced species described in Activity 73, "Introduced Species," are plants: kudzu, purple loosestrife, and hydrilla. Each of these plants is growing successfully in different parts of the United States, partly because they are very well adapted to absorb sunlight and carry out photosynthesis.

a. What effect do you think the growth and spread of these introduced plants will have on native plants? Explain.

b. What effect do you think the growth and spread of these introduced plants will have on animals in the native ecosystems? Explain.